

Name KEY

T01D01:

Stoichiometry Introduction:

1.) Calculate the formula mass of each of the following compounds: [SHOW ALL WORK]

a. sodium sulfate (Na_2SO_4)

$$\begin{aligned} \text{Na} &= 22.98 \times 2 \\ \text{S} &= 32.07 \\ \text{O} &= 16.00 \times 4 \end{aligned} \quad \boxed{142.03 \text{ g/mol}}$$

b. cobalt (III) chloride (CoCl_3)

$$\begin{aligned} \text{Co} &= 58.93 \\ \text{Cl} &= 35.45 \times 3 \end{aligned} \quad \boxed{165.28 \text{ g/mol}}$$

c. magnesium sulfate (H_2SO_4)

$$\begin{aligned} \text{H} &= 1.01 \times 2 \\ \text{S} &= 32.07 \\ \text{O} &= 16 \times 4 \end{aligned} \quad \boxed{98.09 \text{ g/mol}}$$

2.) Determine the mass of **one mole** of each of the following compounds [calculate to the hundredth of a gram. No work needs to be shown. Use your calculator to keep track of the values.]a. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$

$$\boxed{342.34 \text{ g/mol}}$$

b.

 $\text{Al}_2(\text{SO}_4)_3$

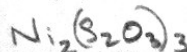
$$\boxed{342.17 \text{ g/mol}}$$

c. $\text{FeO} \cdot \text{Fe}_2\text{O}_3$

$$\boxed{231.55 \text{ g/mol}}$$

d.

nickel (III) thiosulfate



$$\boxed{453.80 \text{ g/mol}}$$

3. Convert the following to moles: [SHOW ALL Work]

a. 3.56 μg ammonium hydroxide (NH_4OH)

$$3.56 \mu\text{g NH}_4\text{OH} \times \frac{1 \text{ g}}{1000000 \mu\text{g}} \times \frac{1 \text{ mol NH}_4\text{OH}}{35.06 \text{ g NH}_4\text{OH}} = 1.02 \times 10^{-7} \text{ mol NH}_4\text{OH}$$

3 sig figs

b. 1.22 kg of table salt, NaCl

$$1.22 \text{ kg NaCl} \times \frac{1000 \text{ g NaCl}}{1 \text{ kg NaCl}} \times \frac{1 \text{ mol NaCl}}{58.44 \text{ g NaCl}} = 20.9 \text{ mol NaCl}$$

3 sig figs

c. 16.65 g of glauher's salt, $\text{Na}_2\text{SO}_4 \cdot 12\text{H}_2\text{O}$

(that is 12 water molecules attached to each mole of glauher's salt)

$$16.65 \text{ g Na}_2\text{SO}_4 \cdot 12\text{H}_2\text{O} \times \frac{1 \text{ mol Na}_2\text{SO}_4 \cdot 12\text{H}_2\text{O}}{358.29 \text{ g Na}_2\text{SO}_4 \cdot 12\text{H}_2\text{O}} = 0.04647$$

$$\boxed{4.65 \times 10^{-2} \text{ mol Na}_2\text{SO}_4 \cdot 12\text{H}_2\text{O}}$$

4. Convert the following to grams: [SHOW ALL Work]

a. 0.135 mmol of potassium phosphate (K_3PO_4)

$$0.135 \text{ mmol K}_3\text{PO}_4 \times \frac{1 \text{ mol}}{1000 \text{ mmol}} \times \frac{212.27 \text{ g K}_3\text{PO}_4}{1 \text{ mol K}_3\text{PO}_4} = 0.0287 \text{ g K}_3\text{PO}_4$$

$$\boxed{2.87 \times 10^{-2} \text{ g K}_3\text{PO}_4}$$

b. 0.225 μmol of magnesium nitrate ($\text{Mg}(\text{NO}_3)_2$)

$$0.225 \mu\text{mol Mg}(\text{NO}_3)_2 \times \frac{1 \text{ mol}}{1000000 \mu\text{mol}} \times \frac{148.33 \text{ g Mg}(\text{NO}_3)_2}{1 \text{ mol Mg}(\text{NO}_3)_2} = 3.34 \times 10^{-5} \text{ mol Mg}(\text{NO}_3)_2$$

3 sig figs

c. 0.550 nmoles of sodium carbonate (Na_2SO_4)

$$0.550 \text{ nmol} \times \frac{1 \text{ mol}}{1 \times 10^9 \text{ nmol}} \times \frac{142.05 \text{ g Na}_2\text{SO}_4}{1 \text{ mol Na}_2\text{SO}_4} = 7.81 \times 10^{-8} \text{ g Na}_2\text{SO}_4$$

* convert nmol \rightarrow mols first

3 sig figs

5. A sample of ethanol, $\text{C}_2\text{H}_5\text{OH}$, contains 6.115×10^{24} molecules, what is the mass of the ethanol in grams?

$$6.115 \times 10^{24} \text{ mc C}_2\text{H}_5\text{OH} \times \frac{1 \text{ mol C}_2\text{H}_5\text{OH}}{6.022 \times 10^{23} \text{ mc}} \times \frac{46.08 \text{ g C}_2\text{H}_5\text{OH}}{1 \text{ mol C}_2\text{H}_5\text{OH}} = 4.679 \times 10^2 \text{ g C}_2\text{H}_5\text{OH}$$

4 sig figs.

6. 19.7 mg of sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$, equals how many atoms.

$$19.7 \text{ mg C}_{12}\text{H}_{22}\text{O}_{11} \times \frac{1 \text{ g C}_{12}\text{H}_{22}\text{O}_{11}}{1000 \text{ mg C}_{12}\text{H}_{22}\text{O}_{11}} \times \frac{1 \text{ mol C}_{12}\text{H}_{22}\text{O}_{11}}{342.34 \text{ g C}_{12}\text{H}_{22}\text{O}_{11}} \times \frac{6.022 \times 10^{23} \text{ mc}}{1 \text{ mol C}_{12}\text{H}_{22}\text{O}_{11}} \times \frac{45 \text{ atoms}}{1 \text{ mc C}_{12}\text{H}_{22}\text{O}_{11}}$$

$$= 1.56 \times 10^{21} \text{ atoms}$$

3 sig figs.

* Must find total molecules of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$, then atoms (total 45/mc).

7.

Formula	Formula Mass (g)	Mass of Sample (g)	Moles of Sample	Number of Particles	Volume of Sample (gas only) (liters)
$\text{C}_8\text{H}_{18}(\text{g})$	114.216	2324	20.34	1.225×10^{25}	455.6 L
$\text{NH}_4\text{OH}(\text{aq})$	35.06	2.02×10^{-3}	5.739×10^{-5}	3.456×10^{19}	NOT A GAS
$\text{Cl}_2(\text{g})$	68.90	0.238	0.00345	2.08×10^{21}	0.0773 L

3 sig figs

4 sig figs.

* Remember.

